

Doing Mathematics with Roma: A Dialogue Between Dialogic Learning and Ethnomathematics

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Abstract

Roma have been excluded from education over the years. Their cultural heritage mediates their ways to learn and use mathematics within the classroom. Drawing on the dialogue between *Dialogic Learning* and *Ethnomathematics* open the possibility to incorporate Roma's voices to the learning process. Interactive groups become spaces for participants to share their own *cultural* strategies to solve mathematical tasks. Egalitarian dialogue, cultural intelligence, and equality of differences are *universal* principles that make possible for all participants in the classroom to draw on their own ways to do mathematics, as stated by the *Ethnomathematics* approach. The challenge for the near future is to identify these *universals* to design inclusive practices in mathematics education.

Keywords: Roma Studies, Dialogic Learning, Ethnomathematics, Egalitarian Dialogue, Cultural Intelligence, Equality of Differences.

Resumen

Las personas gitanas han sido tradicionalmente excluidas de la educación a lo largo de los años. Su herencia cultural media la manera en la que aprenden y utilizan las matemáticas en el aula. Partiendo del diálogo entre el *Aprendizaje Dialógico* y la *Etnomatemática*, se abre la posibilidad de incorporar las voces de las personas gitanas al proceso de aprendizaje. Los grupos interactivos se convierten en espacios donde los participantes comparten sus estrategias *culturales* para resolver tareas matemáticas. El diálogo igualitario, la inteligencia cultural y la igualdad de las diferencias son principios universales que hacen posible que todos los participantes en el aula usen sus propias formas de hacer matemáticas, tal y como establece el enfoque de la *Etnomatemática*. El reto de futuro es identificar estos *universales* para diseñar prácticas inclusivas en educación matemática.

Palabras clave: Estudios Gitanos, Aprendizaje Dialógico, Etnomatemática, Diálogo Igualitario, Inteligencia Cultural, Igualdad de Diferencias.

Introduction

Ten years ago I published the article “*Math is Everywhere: Connecting Mathematics to Students’ Lives*” with my colleagues Ksenija Simic and Maura Varley. In this article, we described the experience of teaching and learning mathematics in an afterschool program addressed mainly to Latino children in an elementary school based in a southwestern city in the USA. That article was connected to my research work as *postdoctoral Fulbright Fellow* at The University of Arizona. There I had the opportunity to meet a great research team at CEMELA – *Center of the Mathematics Education of Latinos/as*. The work that I did gave me the opportunity to know and share the life experience of dozens of Latino families, and their struggle to bring real learning opportunities for their children. I was an observer (and participant actor as well) of the tensions that many Latino families (especially immigrants) experienced when their children asked them for help to solve mathematics homework, and their strategies did not match with the teachers’ way to solve the tasks. I learned many resources new to me (as European visitor), and I helped to develop an inclusive curriculum of mathematics addressed to 3rd graders.

Drawing on the *funds of knowledge* (González, Moll & Amanti, 2006) approach, Ksenija, Maura and myself created an afterschool program addressed to Latino children. We developed memorable activities such as the one called “Cross the Border”, in which the children calculated the amount of water (both in decimal and imperial system) that someone needs to carry on, in order to cross from Mexico into the United States through the border, and not to die during the journey into the desert in doing so; or “La Piñata”, in which the children designed, bought the material, and build a *piñata* using geometric tools and knowledge; or “Mathematics through the professions of my neighbors”, which drove us around the neighborhood to document with video cameras how different

people use mathematics in their corresponding employments. This approach allowed us to make some connections between mathematics and children's everyday life in the *barrio*. But, more importantly, we were able to introduce an Ethnomathematics look to the mathematics present in their cultural context as members of a *borderland* community.

Back in Barcelona I had the opportunity to participate in the study with more resources and greater scientific impact funded by the European Commission within the VI Framework Program: the *INCLUD-ED: Strategies for Inclusion and Social Cohesion in Europe from Education* research project, lead by CREA (Community of Research on Excellence for All), from the University of Barcelona. The main aim of this project was to analyze educational strategies that contribute to overcome inequalities and promote social cohesion, and educational strategies that generate social exclusion, particularly focusing on vulnerable and marginalized groups. This project obtained a great social impact (Flecha & Soler, 2013). According to the goals set by Europe (*Horizon 2020*) and by the United Nations (*UN Sustainable Development Goals*), the researchers working within INCLUD-ED identify *Successful Educational Actions* (SEAs) that succeeded in reducing absenteeism and early school leaving in all the schools involved in the project (over 400 worldwide), increasing school performance (performance rates), and creating employment opportunities in locations of extreme poverty all over Europe (Flecha, 2014). Part of the success of INCLUD-ED is due to include the voices of members of the vulnerable groups through an egalitarian dialogue with the researchers. Using the communicative methodology, we were able to draw on participants' cultural backgrounds to deeply analyze situations within the school.

In this article I want to explain the case of Roma¹ people; I want to discuss how the Roma case illustrates a cultural view of mathematics, which can be *universal* as well. I will use Ethnomathematics and Dialogic Learning as theoretical lenses to think critically on this theme. In fact, this is a reflective article; it is not an empirical one. Roma people define their identity in cultural terms: being Roma means to share certain traditions and customs. Roma is a *nation* “without land,” because for them their identity is not attached to the land, but to those traditions and customs shared by Roma people Worldwide. A common language (with some ethnic dialects), rituals, beliefs, religion, constitutes their *cultural heritage*, which is the basis for their identity as a *Pueblo*. They have survived over the centuries drawing on *oral traditions* passed from one generation to another (Vega Cortés, 1997). Roma still live in a situation of exclusion in Europe, due to the rejection that have experienced traditionally in our *white* and *western* societies. Roma have a culture with ancient roots, broadly present in Europe through the centuries.

Although more than six hundredth years ago a group of *Rromanò Thèm* people left the Punjab and Sinth regions in India, facing Europe until the Iberian peninsula, still nowadays they continue to be seen as *different* and they suffer rejection and persecution in Europe. Roma way of life (based on oral tradition, the respect towards elders, importance of trust word, honor, family, etc.) annoy Europeans, who still see them as “foreigners” and “invaders.” (Unión Romaní, 2016). Roma people have been persecuted, enslaved (until the XIX century), castrated, and almost eliminated (according to Ian Hancock between 70% and 80% of the Roma population in Europe was eliminated during the II World War –Unión Romaní, 2016–). However, it is also true that ways of peaceful coexistence and even integration (respecting the differences)

¹ Roma people prefer to call themselves “Roma” rather than “Gypsies,” which is a non-Roma word to designate them.

have been founded. In recent years Spain and Spanish Roma have become international benchmarks for the rest of Europe, because of their serious work and their effort to create a social movement which is transforming Roma situation; nowadays Roma are becoming literate and many of them are developing academic careers at the University. Ten years ago I discussed the case of Latino families living and experiencing mathematics in a southwestern town in the United States. Ksenija, Maura and I discussed the tensions that Latino children faced in that context, and we showed that it was possible to find sophisticated mathematics within an afterschool program designed with (rather than on) Latino people. In this article I pretend to discuss how Roma also makes essential contributions to the teaching and learning of mathematics, allowing us to broaden the Ethnomathematics approach. In order to do so, we need to create spaces free of stereotypes, where Roma culture could be appreciated as a source of mathematical knowledge. My hypothesis is that Dialogic Learning (DL) has the potential to further develop Ethnomathematics, because it opens the floor to find *universals* that can help us to develop high-quality curricula in mathematics, while being respectful of the diversity and idiosyncrasies of different cultural groups.

Evolution of my Scholarship: Focusing on Vulnerable Groups and Roma Studies

There is very little scientific literature about Roma and education, especially regarding mathematics education and Roma culture (Chronaki, 2005; Stathopoulou and Kalabasis, 2006). This theme is also new from the perspective of the Ethnomathematics. There are no articles about the Ethnomathematics of Roma people.

According to the few studies that we have, Roma children use to be segregated from the mainstream in European schools. Fox and Vidra (2013) claim that Roma children are broadly segregated in the schools, both at the classroom level and at the school level in Bulgaria, Greece, Poland, and Romania. They claim that Roma students “typically

receive a substandard education” (page 3). The reasons for segregation vary from a range of elements, including: school admission policies based on academic achievement rejecting [Roma] underachievers, population racism against Roma, alliances of teachers, parents and, eventually, school administrators as well, to remove “disruptive” Roma students from classrooms and schools. In Hungary, for instance, Roma students are systematically placed on schools for students with special needs (SENs) (Gurzó, 2014). Petrokou and Dimitrakopoulos (2002) report that some educational authorities claim (without any evidence) that “Roma families do not really want their children to attend school (...) the Roma are reluctant to integrate into society...” (New & Merry, 2012, page 630).

In the field of mathematics education, Stathopoulou and Kalabasis (2006) argue that Roma children failure in the school is due, mainly, to their culture as travellers, because Roma have a semi-nomadic way of life. The absence of “written” records in their culture provokes that Roma children “reject” the hegemonic discourse in the school, which is the use of elaborated codes (Bernstein, 1975). According to Stathopoulou and Kalabasis (2006), “Their socio-economic organization based upon family give children the opportunity to be taught by experienced members of the community without conceiving this process as teaching” (p. 152). Orality is in the center of their learning. Stathopoulou and Kalabasis (2006) as well as Chronaki (2005), highlight this aspect as essentially positive from the point of view of developing mathematical abilities such as mental calculation. According to Chronaki (2005) this is a clear advantage of Roma children towards non-Roma students. They are able to stand out using strategies such as piece mail, rounding, grouping, leading digit, compensation, break and bridge, etc. However, Stathopoulou and Kalabasis (2006) claim that the excess of using mental calculation induces children to have difficulties to develop mathematics understanding.

According to them, “They had just made the right application, without taking into consideration the essence of the problem” (p. 154).

Chronaki (2005) does not agree with this view. For her, the oral tradition is not a problem, but a source of possibilities for Roma children. Chronaki (2005) describes and analyzes how two Roma girls use standard *home* strategies (such using fingers to solve arithmetic calculations), along with *school* strategies (defined by Chronaki as words, symbols and methods, formally talking). For her, what happens in the school is a process of transition from *home* towards school-related practices. This is consistent with previous studies in other cultural communities (Díez-Palomar and Civil, 2007; Gutiérrez, Baquedano-López, & Tejeda, 1999).

Nevertheless, this approach involves two main problems: (1) schools do not have spaces to incorporate different voices (those voices that are not aligned with the hegemonic discourse in the school); and (2) there is a clear negative stereotype concerning the cultural identity of Roma children. When I returned to Barcelona from Tucson in 2007, I participated within the research project INCLUD-ED (Flecha, 2014). There I had the great opportunity to work with people from the vulnerable groups, in the frame of Learning Communities (Gatt, Ojala & Soler, 2011; Garcia-Carrión, Gurbés-Peco & Gómez-Zepeda, 2015; Ríos, Herrero, & Rodríguez, 2013). In this context, I met with Roma families, immigrants, people from low socio-economic, etc. All of them had a deep *informal* knowledge of mathematics. They taught me that our classic theories in mathematics education (such as the ones based on cognitive perspectives) have strong limitations to include other “ways to do mathematics.”

But, Ethnomathematics has a conceptual and epistemological framework that makes the integration of *formal* and *informal* mathematics possible. Having in mind that my theoretical background is defined by the DL approach, which draws on the assumption

that (a) everyone is a subject capable of speech and action (in Habermasianian' terms), and (b) our respective knowledge (whether or not formal) is always valid to the extent that it fits the criterion of validity claims, that is: it can be verified by anyone who wants to proof it within the classroom practice, then is it possible that a dialogue between DL and Ethnomathematics might move us [our work] beyond not only in terms of understanding how we teach mathematics inclusively, but also in terms of giving us guidelines to improve our teaching practices in the near future?

Pedagogical Focus: Creating Dialogic Spaces for Learning

Recent literature on education suggests that DL (Flecha, 2000) has contributed to providing an innovative vision of learning to help to overcoming traditional barriers. Based on Habermas, Freire, and others' contributions, Flecha theoretical proposal focuses on the idea of *egalitarian dialogue*, which is one of the seven principles characterizing the DL theory. According to Flecha, individuals use language (dialogue) as a tool for teaching and learning. Using language (as a communicative instrument, which may be in oral form, written, a gesture, a sign, etc.) individuals communicate ideas, concepts, knowledge, etc. Flecha defines different ways to use language depending on the intentions of the people involved in the communicative speech act. An individual can either justify a claim with an argument that can be validated by another individual within the dialogic process or s/he may try to impose his/her claim using his/her power position regarding the other participant(s) in the dialogue. This is what Habermas (1984) defines as power claims vs. validity claims. Drawing on the philosophy of language developed by Searle (1969), this is what characterizes and distinguishes the different speech acts.

Flecha assumes that all people have knowledge (*cultural intelligence*). This principle of the DL is common with the epistemological basis of the Ethnomathematics approach.

The mathematical knowledge is contextual, situated (in Lave and Wenger's terms). However, the *cultural intelligence* as defined by Flecha is a universal concept: despite the differences among individuals, this concept means that all people has something to say when doing mathematics, everyone have their own (situated) mathematical knowledge, that can be used / shared in an egalitarian dialogue where individuals negotiate mathematical meanings embedded in the objects and representations used during the classroom practice. This position means expanding the scope and extent of Ethnomathematics as defined by D'Ambrosio (1985), Gerdes (1996) and others. In other words: the orchestration of knowledge is situated (contextualized), but such "knowledge" (the ability to know) is *universal*. Every human being is able to know mathematically because being a human being.

The dialogue between DL and Ethnomathematics has the potential to overcome the classic criticism against Ethnomathematics itself (Vithal & Skovsmose, 1997). The epistemological basis of the theoretical framework introduced by D'Ambrosio in late 1970s departs from three different aspects: *ethno* (that belongs to the culture of each human group), *mathema* (mathematical knowledge *per se*) and *techné* (which refer to forms of mathematical explanation). As defined by D'Ambrosio (1985): "we will call *Ethnomathematics* the mathematics which is practiced among identifiable cultural groups, such as national-tribal societies, labor groups, children of a certain age braked, professional classes, and so on" (page 45). This definition has been expanded by other authors like Gerdes (1996), who adds the idea of a *cultural system*. Similarly to DL, this approach emerges from the grassroots, as a way to incorporating the voices of people who traditionally are not taken into account within the community of *experts*. History demonstrates that all human groups have developed their own "mathematics," that is: their own way for counting and reasoning. Nevertheless, school mathematics (which

uses what Bernstein would call *elaborated codes*) does not include forms considered as “non-accurate” by the international community of mathematicians.

According to D’Ambrosio, this is because the mathematics that has been imposed in our society is the *western mathematics*, that is: the “heir” of Greeks’ formalisms. But Ethnomathematics expands the scope incorporating “other mathematics.” Some authors have argued that this broader view of mathematics suffers a clear political bias (Knijnik, 1998; Vithal & Skovsmose, 1997). Some of them even claim that Ethnomathematics is a form of postmodern mathematics (Dowling, 1993; Walkerdine, 1990). In several conversations I have had with Gelsa Knijnik over the years, I have always discussed the claim that Ethnomathematics is a form of post-modernism in the field of mathematics education. Throughout our discussions, we always end remembering that this theoretical approach has a *popular* sense *per se* (in Freirean terms). This fundamental meaning is shared with the DL. Ethnomathematics, similarly to DL, emerges from the individuals, includes their ways to do mathematics, and, for that reason, it offers a great platform to legitimize and re-value the different mathematics orchestrated by specific [cultural] human groups. This claim is especially true for those groups that traditionally have been excluded from the mainstream (the legitimated academic discourse), such peasants of the *Movimento Sem Terra* (MST) described by Gelsa, or Roma people, one of the vulnerable groups present in INCLUD-ED (Flecha, 2014).

“Re-incorporating the voices of vulnerable groups” has been a trend in recent decades, especially since social (or socio-cultural) approaches have colonized the field of education (and mathematics education as well). Concepts such as *funds of knowledge* (González, Moll & Amanti, 2006), *hybrid practices* (Gutiérrez, et al. 1999), *dialogic talk* (García-Carrión & Díez-Palomar, 2015; Díez-Palomar, & Cabré, 2015) allow us to update “old” instruments as the zone of proximal development (Vygotsky, 1980) or

“scaffolding” (Wood, Bruner & Ross, 1976) to create more inclusive spaces where everyone can participate and share their ways of doing mathematics. Unlike Ethnomathematics, dialogic mathematics assumes that there are *universals* in the teaching and learning of mathematics; these *universals* must be the benchmark for thinking about successful strategies to teach mathematics in the classroom.

A clear example is *interactive groups* (IG). IG is a successful educational action that improves both students’ performance and coexistence (Valls & Kyriakides, 2013). IG is a type of classroom organization based on heterogeneous grouping (especially in terms of ability). Students are split among three or four small groups. Each one must complete a task. All groups work simultaneously. After 15 or 20 minutes, the members of one group move to the next task, so at the end of the lesson, all students have completed all the tasks proposed. The groups are always facilitated by an adult (volunteer), who should never provide the answer to the task, but rather they should encourage the students to explain and justify with arguments (based on validity claims) their answers, to their peers in the group. The teacher is the one who corrects students’ answers, lately. In these groups, many episodes occur, like the one in which a Roma boy is helping to do division his Senegalese fellow, who is a newcomer to Catalonia and never when to the school in Senegal. The task is to complete a worksheet with 2 digit, 3 digit divisions and so forth (see figure 1).

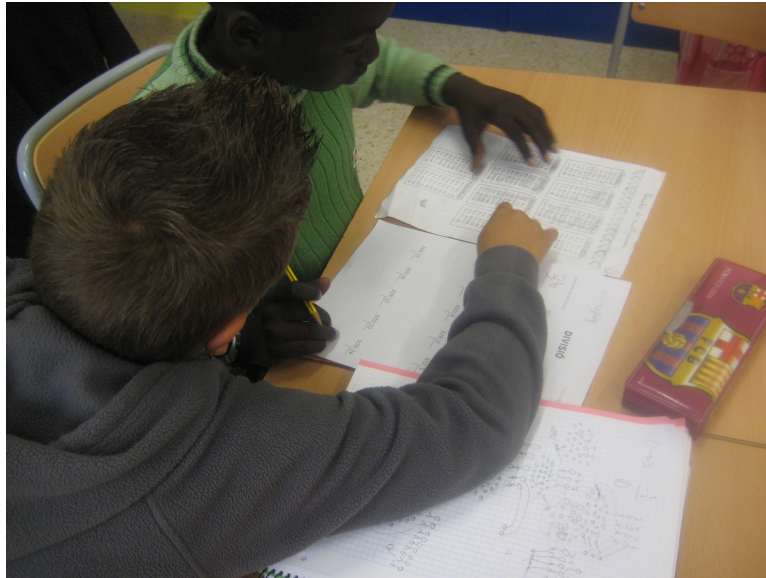


Figure 1. The Roma student and his peer from Senegal, working together to solve divisions
 The Roma boy uses symbolic representations to explain the algorithm of distribution to his partner. He is drawing some puppets and then he distributes circles under each of them until he has no more circles left to distribute (see figure 2).

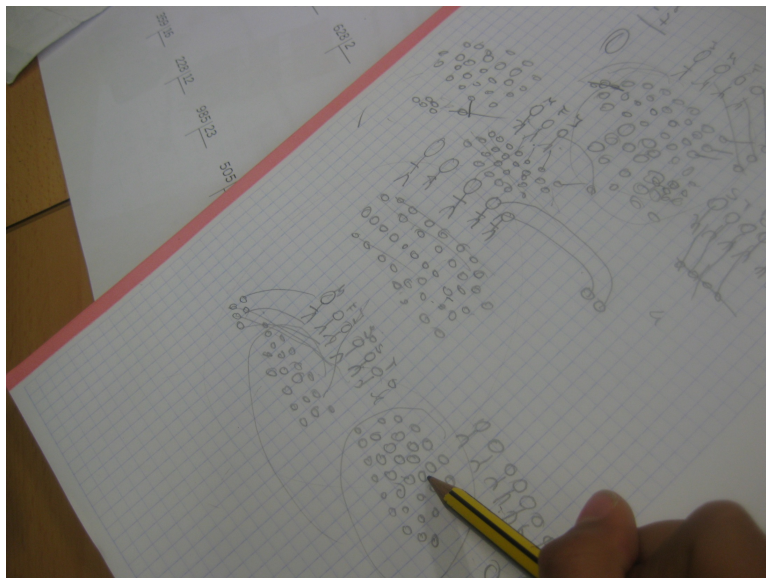


Figure 2. Roma' boy explaining how to divide using iconic representations

Thus, he is representing visually (through icons) divisor, dividend, quotient, and remainder. We can even appreciate that he is highlighting each of these components of the division in the sheet of paper. This iconic representation becomes a visual

instrument that supports the Roma child argument. He uses it to explain the *formal* algorithm of division used in the Catalan schools, to his mate (see figure 3).

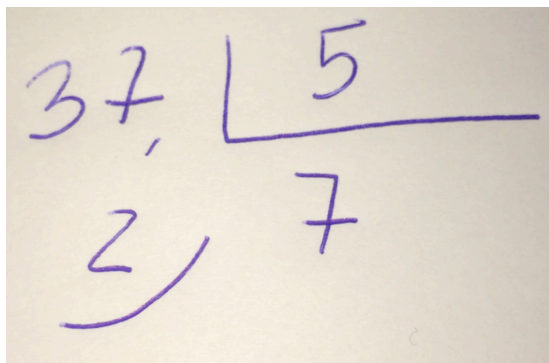


Figure 3. Formal algorithm of division used in Catalan schools

Drawing on an Ethnomathematics approach, we could claim that using this formal algorithm is part of the discursive social practice known as *western mathematics*. However, the Roma child is prompted to look for another strategy to explain how to divide to his peer from Senegal, who barely has being exposed to the basics in terms of literacy. “Explaining our answers to our peers using validity claims” is a requirement of working within IGs. Hence, the Roma child is “forced” to find a different way to explain division. He came with drawings (iconic representations) as a “teaching” instrument to represent visually every part of the formal algorithm. This is a non-standard algorithm equivalent to the one used in Catalan schools (as formal one), making possible to solve the division without knowing the symbolic representation. However, the reasoning embedded in both algorithms is the same in mathematical terms.

This case is not isolated. Stathopoulou and Kalabasis (2006) collected many cases of Roma using oral algorithms to solve problems. Their *classic* analysis of the school (classic in the structuralist sense of Bourdieu) leads them to criticize the school as a space impervious to the particularities of Roma culture: Roma children are marginalized

and fail because neither their speech acts (based on *restricted codes*), nor their *habitus* (as a cultural group) correspond to those legitimated by the school. Being out of the hegemonic school culture is what explains why Roma are not able to succeed in the school (according to Stathopoulou and Kalabasis). But the focus on DL and IGs provides us the possibility to transform the context to turn up this situation: schools that use DL principles not only incorporate the voices of Roma students (and families as well) into the school discourse, but also transforms Roma identity presenting Roma culture as a culture of knowledge and learning. This helps to solve the first problem that I identified above (namely, that schools do not recognize the voice of Roma culture). In addition, evidence from previous studies (Flecha & Soler, 2013) also contributes to overcoming the negative stereotypes towards Roma culture. Federico, a Roma colleague, and friend, who has participated in my research in the *Ramón y Cajal* Program on mathematics education of families of vulnerable groups traditionally excluded from the mainstream, reported that his mother taught him mathematics in order to “prevent that non-Roma people cheat on us”. Federico’s family, like many other Roma families, works on the street market. When Federico was a child, he used to attend the street market to help. As in other famous cases of street vendors reported in the previous literature in mathematics education (Carragher, Carragher & Schliemann, 1985; Jurdak & Shahin, 1999; Saxe, 1988), Federico developed a number of mathematical abilities to do mental calculation, which allowed him to succeed in his academic career (and end up doing doctoral studies). Federico, like other Roma, had to face the contempt towards Roma culture and identity that exists in the hegemonic schools. The inclusion of his voice, similarly to the inclusion of the voices of people like him, contributes to overcoming the second problem that I identified earlier in this article. Our hypothesis for further discussion with the audience of this article is whether

some of the DL principles (*egalitarian dialogue, cultural intelligence, and equality of differences*) may (or may not) help us to broaden the scope of Ethnomathematics to overcome its local and contextualized vision of mathematics practices, to enable us to identify *universals* that may lead to the development of successful educational actions.

Conclusion: Past, Present, and Future of the Ethnomathematics

In 2007, D'Ambrosio complained that the “resistance against Ethnomathematics may be the result of a damaging confusion of Ethnomathematics with ethnic-mathematics (...) which may lead to a folkloristic perception of Ethnomathematics” (p. ix). I think that this criticism of Ethnomathematics as being some sort of *folkloristic* perspective could be due to the fact that Ethnomathematics has been understood as an eminently contextualized (situated) theory of mathematics and its practice. The dialogue between DL and Ethnomathematics could be a way to overcome such criticism. *Contextualism* is more and more questioned. Usually, it is introduced as a way to overcome cultural barriers towards the mathematics understanding (Boaler, 1993). But ultimately this approach did not give the expected result so far. We can identify what is different in cultural (ethnic) terms, regarding how different individuals use / apply mathematics. However, in doing so does not mean that our practices as professionals in education will be inclusive (as D'Ambrosio complaints when he was a professor at SUNY). If this happens, the situation does not improve for the ones who use to be excluded from the regular educational system (like many Roma children). For this reason, many researchers worldwide suggest that the future trend for research is going to be to identify SEAs, that is: those *universals* which enable us to develop inclusive policies, actions and practices working for everyone, as well as respecting everyone's' cultural differences. After several decades studying and doing research, I tend to think that mathematics is a universal set of knowledge that manifest itself in situated practices.

Concepts such as *hybrid practices* or *dialogic talk* are instruments to overcome the school resistance towards other types of *codes* that are not hegemonic.

In Ramon Flecha's words, we must find those active ingredients inherent to our human condition, and like happens with our bodies responding positively most of the times to a drug such penicillin (because everyone is made of the same material, regardless our beliefs, country of origin, socioeconomic status, skin color, gender, etc.), we need to find those *universal* ingredients in the educational field that make all individuals to respond positively (successfully) when learning mathematics. This is our challenge for the coming years.

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